Author: Kurtz, Ray Abraham

Title: A study of the comparative amount of science information possessed by the farmers and the future farmers of Lebanon County, Pennsylvania

Place of Publication:

Copyright Date: 1939

Master Negative Storage Number: MNS# PSt SNPaAg032.6

<105425> * *OCLC* Form:manuscript item 2 Input:CHF Edit:FMD
008 ENT: 980223 TYP: s DT1: 1939 DT2: LAN: eng
035 (OCoLC)38448473
037 PSt SNPaAg032.6 $bPreservation Office, The Pennsylvania State University, Pattee Library, University Park, PA 16802-1805
090 20 Thesis 1939m $bKurtz,RA $cax*7347542 $cax+(Archival)
090 20 Microfilm D344 reel 32.6 $cmc+(service copy, print master, archival master)
100 1 Kurtz, Ray Abraham.
245 12 A study of the comparative amount of science information possessed by the farmers and the future farmers of Lebanon County, Pennsylvania $ba thesis $cby Ray A. Kurtz.
260 $c1939.
300 61 leaves $bill. $c29 cm.
502 Thesis (M.S.)--Pennsylvania State College.
504 Bibliography: leaves 56-61.
533 Microfilm $bUniversity Park, Pa. : $cPennsylvania State University $d1997. $e1 microfilm reel ; 35 mm. $f(USAIN state and local literature preservation project. Pennsylvania) $f(Pennsylvania agricultural literature on microfilm).
590 Archival master stored at National Agricultural Library, Beltsville, MD : print master stored at remote facility.
590 This item is temporarily out of the library during the filming process. If you wish to be notified when it returns, please fill out a Personal Reserve slip. The slips are available in the Rare Books Room, in the Microforms Room, and at the Circulation desk.
650 0 Science $xStudy and teaching $zPennsylvania $zLebanon County.
650 0 Agricultural education $zPennsylvania $zLebanon County.
830 0 USAIN state and local literature preservation project. $pPennsylvania.
830 0 Pennsylvania agricultural literature on microfilm.

THE PENNSYLVANIA STATE COLLEGE

THE GRADUATE SCHOOL

DEPARTMENT OF EDUCATION AND PSYCHOLOGY

A STUDY OF THE COMPARATIVE AMOUNT OF SCIENCE INFORMATION POSSESSED BY THE FARMERS AND THE FUTURE FARMERS OF LEBANON COUNTY, PENNSYLVANIA.

A Thesis

by

Ray A. Kurtz

Submitted in partial fulfillment of

the requirements for the degree of

MASTER OF SCIENCE

August 1939.

Approved:

July 27, 1939

Thos. C. Peters.
Prof. of Education

Bruce V. Moore

ACKNOWLEDGMENTS

This study would hardly have been possible without the cooperation of many people. It is a pleasure to acknowledge the cooperation and assistance of the school authorities, the Future Farmers of America, and the farmers of Lebanon County. It is only through their assistance and help that this study has been made possible.

The writer feels deeply grateful to Dr.C.C.Peters for his helpful suggestions, and to Professor Lloyd Lebo for his willingness to administer many of the tests. He wishes to gratefully acknowledge the assistance and encouragement of his wife.

R.K.

209852

CONTENTS

Chapter — Page

I.STATEMENT AND ANALYSIS OF THE PROBLEM----------1

A.Purpose of the problem----------1

B.Scope of the problem----------2

C.Previous studies----------3

D.Summary of the previous studies----------10

II.DATA AND THEIR TREATMENT----------11

A.Construction of the science infromation test----------11

1.Criteria for the test----------11

2.Construction of the test----------12

3.The subject matter of the test----------12

4.Method of administering the test----------13

B.Additional information included in the test----------15

C.Method of scoring the tests and evaluating the results-16

D.Summary of the treatment of the data----------17

III.AN ANALYSIS OF THE RETURNS OF THE TEST----------18

A.Findings as determined by the per cent of both groups who missed or omitted each item in the test----------18

B.Findings of the test as determined by the scores evaluated by statistical measures of central tendency,variation,and correlation----------25

C.Findings of the test as determined by the per cent of each group missing or omitting each item in the six subject matter divisions----------27

1.Findings for the superstition division----------27

2.Findings for the biology division----------30

3.Findings for the chemistry division----------33

4.Findings for the physics division----------36

5.Findings for the health division----------39

6.Findings for the general science division--------41

7.Findings from a composite summary of all divisions of the test----------41

D.Findings as determined by the part of the test which asked the participants to check the subjects they thought should receive more emphasis in our high schools---------45

E.Summary----------47

IV.SUMMARY AND CONCLUSIONS----------49

A.Series of general conclusions----------49

B.Interpretation of the results----------50

C.Limitations of the conclusions----------51

V. APPENDICES----------52

A. A list of the voluntary suggestions of the farmers----53

B.A list of the voluntary suggestions of the future farmers----------54

C. Mean scores of the farmers grouped according to educational attainments----------55

VI.BIBLIOGRAPHY----------56

TABLES

Number	Title	Page
I.	Health information test items ranked in descending order according to the percentage of nine hundred eighty-nine seventh grade white students marking each item incorrectly	7
II.	A partial list of some of the items of science misconceptions held by a group of elementary teachers in training taken from a study of Ralya and Ralya	9
III.	Division of items in test according to subject matter of item	13
IV.	Test items ranked in order of decreasing difficulty as determined by the per cent missed or omitted by the combined groups	20
V.	Findings of the test as determined by measures of central tendency and variability based on the scores of the number correct	26
VI.	Correlations of the scores of number correct with other factors	26
VII.	Findings of the test as determined by the per cent missed or omitted for both groups of each item related to superstition	28

VIII. Findings of the test as determined by the per cent missed or omitted by the combined groups for the items related to biology---------- 31

IX. Findings of the test as determined by the per cent missed or omitted by both groups for each item related to chemistry---------- 34

X. Findings of the test as determined by the per cent missed by both groups for each item related to physics---------- 37

XI. Findings of the test as determined by the per cent of both groups who missed or omitted each item related to health---------- 40

XII. Findings of the test as determined by the per cent of both groups who missed or omitted each item related to general science---------- 42

XIII. Composite summary of the mean per cents missed and omitted by both groups for each item in the subject matter divisions---------- 43

XIV. Showing the per cent of each group who checked certain subjects as needing more emphasis on the high school curriculum---------- 46

CHARTS

Number	Title	Page
1.	Extend of science misconceptions held by the farmers and future farmers as determined by the mean per cent of each group missing each item in the subject matter divisions of the test	44
2.	Distribution of the scores made by the farmers and the future farmers on the science information test	48

CHAPTER ONE.

STATEMENT AND ANALYSIS OF THE PROBLEM.

A. PURPOSE OF THE PROBLEM.

Science education has become a recognized part of every high school curriculum. All the high schools of the country have admitted courses in science education into their courses of study. The social environment and the industrial surroundings are so full of scientific phenomena that no individual can escape contact with them. Due to the vastness of the field of scientific phenomena, it is hardly possible to get a fair measure of the amount of correct science information possessed by any individual or group of individuals. A few studies in the field show a surprising amount of misinformation concerning scientific facts among the adult population of our country. This study tries in a small measure to determine the relative amount of correct science information possessed by a limited group of our population.

In certain respects,no group of our population is in as close contact with the everyday facts of science as the farmer group. Few parts of our population can use as large an expanse of scientific facts as the part engaged in agriculture. Consequently,the farmers of ourland should be acquainted with a large amount of scientific facts. It is the purpose of this

study to determine the relative scope of the science information on the part of the farmers.

Agricultural education has become a recognized part of the curriculum of many of the rural high schools and vocational schools of our country. The leaders in the field of vocational agriculture have long realized the close relationship between agricultural education and science education. The boys who are enrolled in the classes in vocational agriculture have been organized into the Future Farmers of America. Since these boys are to become the farmers of our land tomorrow, the study purposes to find the comparison between the amount of science information of the future farmers with that of the farmers.

B. SCOPE OF THE PROBLEM.

The field of science information is almost unlimited. This study was limited to the type of science information one would secure from a four year high school science course. Since the boys in vocational agriculture are in many cases required to take four years of high school science, the leaders in vocational agriculture must recognize the close relationship between agriculture and high school science.

This study was further limited to a typical farm community of rural high schools with future farmer chapters.

The future farmers and the farmers were selected from the same community. This selected community was Lebanon County in the State of Pennsylvania.

C. PREVIOUS STUDIES.

A careful review of the field of literature reveals few or no studies comparable in full with this one. There were several studies made on the amount of health information, the amount of superstitious beliefs, and the scope of science information among certain other groups. A review of a few of these previous studies follows:

(1). In 1934, Wrightstone[1] gave a test comprising ninety items relating to science beliefs to the pupils in grades seven to twelve in the schools of Summit, New Jersey, and Bronxville and Rochester, New York. He correlated their natural science beliefs with verbal intelligence, achievement from a standardized test in general science, and their socio-economic status. He found that; that the IQ shows a positive, though low, correlation with the score on natural science beliefs; that knowledge of natural science shows a marked correlation with desirable natural science beliefs;

1. Wrightstone, J.Wayne; Correlation of natural science beliefs and attitudes with social and intellectual factors. Science Education Volumn XVII (February 1934) pp. 10-12.

and that the socio-economic status reveals negligible correlation with natural science beliefs of secondary school pupils.

(2) In 1930, Stemple made a study[2] of 1,067 activities of the people in four different types of communities in West Virginia with reference to the contributing values in science. His findings were: So far as activities are concerned, biology seemed to be the most important subject for the small high school. Physics and chemistry seem about equally important. The activities involve, in at least half the cases, more than half of the sciences in combination. The separating of sciences in teaching may be logical but it is not practical.

(3). Caldwell and Lundeen[3] gave a list of 200 true-false statements designed to measure belief in or attitude toward common superstitions to the junior high school pupils of Albert Leonard School, New Rochelle, New York. They found a definite correlation between age and the number of items marked wrong within a given grade. That is on a whole, older pupils are more superstitious than the younger pupils within the same grade. The IQ for ninth grade pupils showed a slightly negative correlation with superstition. It is a reasonable assumption

2. Stemple, Forrest D. Science needs of pupils in small high schools, based on an activity analysis. Doctor's thesis (1930) Cornell University, Ithica, New York.

3. Caldwell Otis W. and Lundeen, Gerhardt E. Further study of unfounded beliefs among junior high school pupils. Teachers College Record Volume XXXVI (October 1934) pp. 35-52.

that the known school instruction is one of the causal factors in the change of the average amount of superstition.

(4) Clem and Dudlestone[4] investigated 1070 pupils in forty science classes through school records, questionaires, and personal interviews. Functional knowledge was measured by a multiple response test of fifty items. A summary of the findings show that: a. A pupil's knowledge of common science consistently increases with the amount of science passed. b. There is a definite positive relationship between knowledge of common science and age. c. Knowledge of common science is positively related to the amount of education possessed by the parents. d. Pupils who work regularly out of school excel those who do not. e. Children of smaller families excel those of larger families in common science knowledge.

(5) In 1933, Maller and Lundeen[5] submitted a list of fifty statements of common superstitions and other unfounded beliefs to 179 junior and senior high school pupils. They were asked to state for each item whether or not they believed it to be true and to indicate whether they were informed concerning the correctness of the item or the incorrectness of it from the following sources: home, friends, church, school, books, newspapers, and observation. The average pupil expressed a belief in

4. Clem, Arlie M. and Dudlestone, Joseph J.; Factors influencing the common science knowledge of high school pupils. Science Education Volume XVII (December 1933) pp. 267-272.

5/ Maller, Julius B. and Lundeen Gerhard; Sources of superstitious beliefs. Journal of Educational Research volum XXVI (January 1933) pp. 321-343.

thirty per cent of the items, a disbelief in fifty-five per cent ,and uncertainty in about fifteen per cent of the items. Young pupils were found to believe in a greater number of the items than the older pupils. Friends ranked first in the order of fostering superstitions. Next in order was the home, while educational sources and observation were found to contribute least to the belief in superstitions. The order of the sources in correcting superstitions was: observations, educational sources, home, friends.

(6) In a study [6] by Salt, a health information test of 300 true-false items was administered to 3,221 pupils in grades seven to twelve in twenty-six schools for white pupils, and to 592 pupils in the same grades in six schools for negro children. The test ascertained the relative prevalence of certain health misconceptions among seventh,tenth,and twelfth pupils of the white and colored schools of Florida. A few of the items with the responses are given in Table I. The author concluded that unfounded beliefs relating to health are found to be quite prevalent,and it appears that formal education has failed to a marked degree to eliminate certain health misconceptions from the beliefs of students in seventh, tenth,and twelfth grades of the state of Florida. The author

(6) Salt Benton E.; Health misconceptions of seventh, tenth,and twelfth grade students. Journal of Educational Research volume XXII (September 1938) pp.61-80.

TABLE I.

HEALTH INFORMATION TEST ITEMS RANKED IN DESCENDING ORDER ACCORDING TO THE PERCENTAGE OF NINE HUNDRED EIGHTY-NINE SEVENTH GRADE WHITE STUDENTS MARKING EACH ITEM INCORRECTLY.

Rank	Item	Correct response	Per cent responding incorrectly
1.	Everyone should engage in deep breathing exercises daily.	F	92
2.	Returning canned milk to the refrigerator in its original container after it has been partly used will cause tin or lead poisoning.	F	89
3.	Milk contains all the essential elements of a good diet and in sufficient quantities to insure good health and normal body development.	F	88
4.	It is more dangerous to prick ones self with a pin than with a needle.	F	86

stated that there is very little relationship between the factual health knowledge which the white students of seventh, tenth, and twelfth grades possess and the degree to which they subscribe to certain health misconceptions. The reactions with respect to certain health misconceptions were approximately the same for students living in rural and in urban communities.

(7) Ralya and Ralya administered a test[7] of 240 items to 130 women college students, all of whom were preparing to teach in elementary schools. A few of the items with the per cent of error are given in table two. (TableII) The authors arrived at several significant conslusions. "A significant percentage of these prospective teachers exhibited ignorance or misconceptions of many simple and basic facts and principles, knowledge, and understandings which would be necessary for any adequate presentation of elementary science in the classroom. A significant percentage of these prospective teachers believed many folks superstitious, some of them harmful in themselves and others harmful in that they stand in the way of thinking and rational action#

7. Ralya, Lynn L. and Ralya, Lillian L.; Some misconceptions held by prospective elementay teachers. Science Education. volume XXII (October 1938) pp.244-251.

TABLE TWO.

A PARTIAL LIST OF SOME OF THE ITEMS OF SCIENCE MISCONCEPTIONS HELD BY A GROUP OF ELEMENTARY TEACHERS IN TRAINING TAKEN FROM A STUDY BY RALYA AND RALYA.

Item	Per cent of error
1.The earth is a planet.	3
2.The solar systme consists of only one star.	85
3.The sun is much bigger than any other body in the heavens.	41
4.The sun is a star.	13
5.The earth is located at the exaxt center of the universe.	10
6.The moon is closer to the sun than is the earth.	26
7.The stars shine because of the light which is reflected from the sun.	48
8.The sun remains in a fixed position is space.	37.
9.Water is an oxide.	25
10.Iron rust is heavier than the iron out of which it was formed.	31
11.An explosion of coal dust is a case of very rapid burning.	19
12.The pressure of the air is,on the average, about fifteen pounds per square inch.	15
13.All matter contains electricity.	28
14.A volt represents an amount of electricity.	52
15.Radio waves need air to travel on in going from station to station.	62
16.Sound will travel through a vacuum.	27.
17.Bacteria are plants.	35
18.All molds are harmful.	20
19.The whale is the largest known fish.	58
20.Horsehairs never develop into snakes.	17
21.All human beings begin life as fertilized eggs.	8
22.Fish are an especially food for the brain.	28
23.Sassafras tea purifies the blood.	37
24.Rattlesnake oil is not a cure for rheumatism.	16.

D. SUMMARY OF THE PREVIOUS STUDIES.

1. Formal education is not functioning as it should in destroying common health and science misconceptions.

2.There is a very close relationship between science knowledge and the daily activities of life on the part of the average individual.

3.There seems to be little evidence of the decrease of common misconceptions among our population.

4. There is no one factor which can be named as the possible cause of the apparent amount of science misconceptions.

5. There is little evidence to show that older people believe fewer of the common misconceptions than younger folks.

6.There is a surprising amount of science misconceptions even among those groups who should,by reason of training and vocation, be largely free from these misconceptions.

CHAPTER TWO.

THE DATA AND THEIR TREATMENT.

A.CONSTRUCTION OF THE SCIENCE INFORMATION TEST.

In order to secure a reliable determination of: 1. the amount of science information and misinformation among the farmers of Lebanon county; and,2. a comparison of their information with that of the Future Farmers of America now in school; a science information test was developed and administered to both groups.

1.Criteria for the test.

In order for such a test to be useful, it had to fulfill the following conditions;

a.Each item had to be related to some definite scientific fact. Any debatable items were not included.

b. The wording of each part had to be such as to leave no doubt in any one's mind as to the meaning. To verify this criterion,the test items were included in regular high school tests given by the author to a neutral group.

c.It should be easily and correctly administered. To conform the test to this requirement, the true false type of statements were used in the test. Two columns were provided; one in which to check if the statement is false,and one to check if the statement is true.

d.The test must be reliable and valid.

e.The test must be easy to correct and score.

2.Construction of the test.

The list of eighty statements,whether true or false, were drawn directly from the following sources;

a.High school science and health text books.*

b.Books of local superstitions.*

c.Other tests of science information.*

d.Pennsylvania state course of study for;

(1) Biology

(2) Chemistry

(3) Physics

(4) Health Education.

There were thirty-seven true statements in the test and forty-three false statements in the test. There were eighty statements in the entire test. All of the items were of the true false nature.

3. The subject matter of the test.(Table III.) The subject matter of the test was distributed among six science fields. Five of the fields were subjects found on the high school curriculum. The sixth division had to do with superstition. There were twenty-three biology items,twenty-two

*Listed in Bibliography.

TABLE III.

DIVISION OF ITEMS IN TEST ACCORDING TO SUBJECT MATTER OF ITEM.

Subject	Number of items
Biology	23
Superstitions(including all subjects)	22
Chemistry	21
Physics	16
Health Education	10
General Science	8
Grand total for all subjects.-	100
Less items duplicated;-	20
Total items in the test;-	80

superstition items,twenty-one chemistry items,sixteen physics items,ten health items, and eight items classified as gereral. The items in the test were not arranged in any order according to the particular division to which they belonged. Due to the close relationship between the six fields chosen as the divisions of the test, several of the items appear in more than one division. Twenty items are thus classified.

4.Method of administering the test.

a.To the farmers of Lebanon county. Copies of the science information test were mailed to 400 farmers of Lebanon county. These farmers were selected by taking every third one from a list of the farmers of the county supplied by the county offices. Each test included a return,stamped, self-addressed envelope; and full directions for taking the test. Fifty-two returns were received. This is a thirteen per cent response. In order to increase the amount of the returns,reminders were given by card,sending of new tests, and personal solicitation. There was a great amount of unwillingness to participate in something that might get them into trouble.

b.To the Future Farmer of America. After having received the responses from the farmers,the test was administered to the members of the Future Farmers of America chapters in the county by the County Agricultural Supervisor. These tests were administered directly to the future farmers in their

classes in vocational agriculture. The schools in which the tests were given were scattered over the entire county. Six of the eleven high schools of the county participated in the test. Fifty-six returns were received from the tests given to the future farmers. There were some eighty boys in the organization in the county at the time of the test. This would make a seventy per cent response for the future farmers.

B. ADDITIONAL INFORMATION INCLUDED IN THE TEST.

Each of the participants in the test was asked to include a report of the number of years in school.;thatis, the number of years in grade school,the number of years in country school, the number of years in high school,and the number of years in normal school or college. They were also asked to include the number years of farming.By this means, a correlation between the number of years in school and the results of the test was determined. A correlation between the number of years of farming and the results of the test was also determined.

Both groups were given the opportunity to check from a list of subjects the ones they thought should receive more emphasis in our high schools. Opportunity and space was provided for any voluntary suggestions they might care to make.

C. METHOD OF SCORING THE TEST AND EVALUATING THE RESULTS.

In sending out the test, instructions were given that each item should be answered according to their best judgment. The tests were then scored on the basis of the number of correct responses. There were no corrections made for guessing, since no stipulation about guessing was made in the instructions. The scores for the farmers and the future farmers were kept separate in order to facilitate the comparison of the two groups. The number of misses for each item were tabulated as well as the per cent of misses by both groups for each item.

The measures of central tendency and variability were determined for the two groups. The correlation between the scores and the number of years in school, and the correlation between the scores and number of years of farming were secured for comparison and study. The standard error for each of these items was determined. The items of the test were tabulated according to the subject matter divisions. All correlations were determined by the Pearson Product Moment formula. The coefficient of correlation between the scores of the two groups was .774.

The coefficient of correlation of the test as determined by correlating the odds with the evens was .919. The coefficient of reliability of the test from the Spearman Brown formula was .957.

D. SUMMARY OF THE TREATMENT OF THE DATA.

1.The data for the science information test were secured through reliable science and health sources.

2.There were eighty true-false statements in the test distributed over six different subject matter divisions.

3.The test was administered by mail to the farmers, and directly to groups of the future farmers.

4.There were fifty-two responses from the farmers and fifty-six from the future farmers.

5.The test was limited to Lebanon county of the state of Pennsylvania.

6.The results of the test were evaluated by accepted statistical and educational methods.

7. The coefficient of reliability of the test is .957.

CHAPTER THREE

AN ANALYSIS OF THE RETURNS OF THE TEST.

A. FINDINGS AS DETERMINED BY THE PER CENT OF BOTH GROUPS WHO MISSED OR OMITTED EACH ITEM IN THE TEST. (Table IV.)

In order to get a measure of the relative difficulty of each of the test items, the eighty true and false statements were arranged in descending order according to the frequency each item was marked incorrectly by the two groups.This ranking was accomplished by considering the per cent of omissions and misses by the farmers, the future farmers,(F.F.A.),and the two groups combined.

The only fair generalizations which can be made from the findings of this arrangement are:

1.The three items which both groups missed most frequently are of a definitely technical nature.

2.Of the first fifteen items missed most frequently by by both groups, nine of them were items relating to common misconceptions rooted in local superstition.

3.Outside of the relatively high percentage of superstitions missed in the first fifteen, no particular science field ranked higher than any other in the number of items listed in any part of the rank.

4.The items listed as missed least frequently show a marked relationship to the environmental factors of the groups participating in the test. These items could have been answered from the observation of environment without resort to formal education.

5.It was a bit of a surprise to find where some of the items ranked in the returns. That the item relating to the treatment of weak arches with arch supporters should stand fourth in the list was rather surprising. There may be a strong advertising program in the county for shoes containing arch supporters. One would hardly expect the item concerningthe killing of frogs so near the bottom of the list.

6.One of the revealing findings of the test is the close agreement between the returns of the two groups. For forty-four of the eighty items,the per cent of misses between the two groups is not greater than ten. There were sixty-six statements missed by one group more frequently than the other by a difference of less than twenty per cent.The difference between the two groups was between twenty and thirty per cent in only ten cases. In only one case was the difference greater than forty. The future farmers missed thirty-six of the eighty test items more frequently than the farmers;while the farmers missed forty-one of the items more frequently than the future farmers.In three items,there was no significant difference between the two groups.

TABLE IV.

TEST ITEMS RANKED IN ORDER OF DECREASING DIFFICULTY AS DETERMINED BY THE PER CENT MISSED OR OMITTED BY THE COMBINED GROUPS.

Item		Per cent missed or omitted by: Farmer	F.F.A.	Combined groups.
1.Leaves of trees turn toward sunlight,because they need sunlight for growth.	(F)	81	93	87
2.The lever used in lifting a stone uses more energy than lifting it directly.	(F)	90	82	86
3.The oxygen in the air is the cause for all combustion and burning and is necessary for all life.	(F)	81	92	86
4.The best treatment for weak arches is to wear arch supporters.	(F)	88	79	83
5.Copper is the best conductor of electricity.	(F)	85	71	78
6.The sun is nearer the earth in summer than in winter.	(F)	63	71	67
7.Evolution says that man descended from the monkey.	(F)	62	70	66
8.Ice cream and fish should never be eaten to-gether.	(F)	69	61	65
9.If you hear a train whistle at a distance it is a sign of rain.	(T)	66	64	65
10.Doctors do not the cause of influenza or the "flu".	(T)	50	74	62
11.The sap of trees goes up in spring and down in fall.	(F)	50	74	62
12.Strong dring keeps one warm.	(F)	48	64	56
13.There is no such thing as "pigeon's milk.	(F)	52	54	53
14.A cat can see better in the daytime than in the dark.	(T)	60	46	53
15.A person falling from a great is dead before reaching the ground.	(F)	60	46	53
16.An example of a strong alkali is carbolic acid.	(F)	54	53	53
17.It would be dangerous to connect a 220 volt electric iron to a 110 volt current.	(F)	52	52	52

TABLE IV (continued)

18.Electricity moves from the negative pole of the battery to the positive.	(T)	63	41	52
19.If you apply clay to a sting, it will draw it out.	(F)	50	50	50
20.Diabetes is the result of a poorly functioning liver.	(F)	60	39	49.5
21.That the ostrich hides its head in the sand is a myth.	(T)	46	52	48
22.The common fertilizer contains but a few of the materials needed for plant growth.	(T)	29	66	47.5
23.A body one-half as heavy as water will float with three-fourths of its volume below the surface.	(F)	62	30	46
24.Due to the time needed for radio messages to travel,radio time is a minute or two late.	(F)	48	43	45.5
25.Water is "hard" because of the salts dissolved in it.	(T)	48	41	45
26.Fuses are placed in buildings to protect them against lightning.	(F)	67	18	43
27.Steel is pure iron.	(F)	47	38	43
28.Children should have the measles,besause the measles are often fatal to older people.	(F)	54	29	42
29.The gas,which is used in stoves and distributed through pipes, is mined.	(F)	42	39	41
30.Brass is a metal mined in certain parts of the United States.	(F)	42	39	41
31.There are machines whose efficiency is as high as 99 or 100 per cent.	(F)	46	34	40
32.A solid iron bar is stronger than a hollow one of the same diameter.	(T)	40	39	40
33.Only by actual biting can a snake poison and harm an individual.	(T)	31	45	38
34.Gold is the most valuable metal.	(F)	35	41	38
35.Alfalfa and clover are planted only for the forage and food for animals.	(F)	50	25	37.5
36.The trichina is a dangerous worm found in old vinegar.	(F)	30	45	37

TABLE IV (continued)

37.D.C. and A.C. are terms for different types of electricity.	(T)	38	36	37
38.Snakes have a dry scaley skin.	(T)	31	43	37
39.Force,power,work mean the same thing.	(F)	40	33	36
40.Winds blow from places of low pressure to places of high pressure.	(F)	54	18	36
41.The earthworm is an economical and valuable animal because it brings fertile subsoil to the surface.	(T)	27	43	35
42.Aching corns are a sign of coming rain.	(F)	42	27	35
43.The corn plant produces no flowers.	(F)	38	30	34
44.Glass is made from sand and soda.	(T)	38	30	34
45.The acid found in storage batteries is strongest when the battery is weak.	(F)	37	29	33
46.Chimney sparrows breed or bring bedbugs.	(F)	43	22	33
47.In a plane mirror,the image is as large as the object.	(T)	25	39	32
48.The greatest height to which water can be lifted in a siphon is fifty feet.	(F)	40	41	30
49.Rayon is a type of cloth made from wood pulp.	(T)	44	16	30
50.The "silver paper" used to wrap candy is a cheap form of silver.	(F)	29	30	30
51.The color of deep bodies of water is due to the sand or ground in the bottom.	(F)	33	22	27
52.The production of clover seed is made possible by frequent visits of the bumblebee to the flowers.	(T)	17	37	27
53.Liquids tend to rise in small tubes,spaces,or cracks.	(T)	25	29	27
54.A pound of feathers is lighter than a pound of lead.	(F)	21	29	25
55.A blacksmith tempers steel by running a current through it.	(F)	23	25	24

TABLE IV (continued)

56.The dragon fly,commonly called the snake doctor, is of benefit to the common water snake.	(F)	29	18	23
57.Milk is pasteurized to remove the disease germs.	(T)	13	32	23
58.Cement will harden under water.	(T)	6	34	20
59.Fish hung in moonlight will spoil more quickly.	(F)	23	16	19
60.Most advertised cures for deafness are worthless.	(T)	15	23	19
61.Carbolic acid is poisonous.	(T)	13	23	18
62.If Canadian thistles are cut in the month of August in the sign of Leo,they will not sprout again.	(F)	15	21	18
63.The sun is the source of all the earth's heat and energy.	(T)	11	22	17
64.As the last Friday of the month so the following month.	(F)	15	18	16
65.Quicklime is made from ordinary sandstone.	(F)	17	16	16
66.One would take baking soda for an acid stomach.	(T)	11	20	16
67.Bacteria,one celled plants,are known to the cause of many of our diseases.	(T)	13	18	15
68.Iron is secured from its ore in the blast furnace.	(T)	13	16	14
69.Weather reports are guesses made by the United States weather bureau from the appearances of the sky.	(F)	17	11	14
70.Boils are caused by bad blood in the body.	(T)	13	11	12
71.An explosion of gunpowder is a type of very rapid burning.	(T)	11	11	11
72.Sulfur is found in coal.	(T)	6	16	11
73.Grease can easily be removed from clothing with the use of gasoline.	(T)	13	7	10
74.The white maggots,so frequently found in manure piles,develop into flies.	(T)	11	7	9
75.Since plants alone manufacture food,all animals are directly or indirectly dependent upon plants.	(T)	4	12	8

TABLE IV (continued)

76.Frogs should not be killed, because they catch and eat many harmful insects.	(T)	10	4	7
77.One sees lightning before one hears the thunder,because light travels faster than sound.	(T)	6	7	7
78.Dandelion seeds are scattered by the wind.	(T)	6	7	6
79.Wheat fields are protected by a covering of snow.	(T)	2	11	6
80.Soaps are made from alkalies, such as lye,and fats.	(T)	4	5	4

B. FINDINGS OF THE TEST AS DETERMINED BY THE SCORES EVALUATED BY STATISTICAL MEASURES OF CENTRAL TENDENCY, VARIATION, AND CORRELATION. (Tables V and VI.)

In order to compare the two groups, both groups were scored on the number of correct responses; for the directions of the test asked them to mark each one according to their best judgment. The median and the mean were then determined for each group. To show the range of variability, the median and standard deviations were calculated for each of the groups.

The measures of central tendency show surprisingly little difference between the two groups. The future farmers are consistently higher than the farmers; while the farmers show a greater variability among their scores than do the future farmers. The group comprised of the future farmers may have been a more homogeneous group than the farmers.

To determine the correlation between the scores and the number of years in school, and the correlation between the scores and the number of years of farming, the coefficients of correlations between this factors were calculated by the Pearson product-moment formula.

The coefficient of correlation between the scores, made on the test, and the number of years in school shows a positive correlation for the farmers, and for the future farmers. The coefficients are surprisingly small, but large enough to show a definite relationship between the amount of science information and the number of years spent in school. The coefficient

TABLE V.

FINDINGS OF THE TEST AS DETERMINED BY MEASURES OF CENTRAL TENDENCY AND VARIABILITY BASED ON THE SCORES OF NUMBER CORRECT.

Measure	Farmer	S.E.	F.F.A.	S.E.	Diff.	S.E.
1.Mean	50.58	1.18	51.14	.88	.56	1.08
2.Median	51.36	1.47	51.43	1.10	.09	1.84
3.Standard deviation	8.64	.84	6.60	.62	2.04	1.04
4.Median deviation	6.52	.56	5.38	.42	1.15	.69

TABLE VI:

CORRELATION OF THE SCORES OF NUMBER CORRECT WITH OTHER FACTORS.

Factors correlated	Farmer	S.E.	F.F.A.	S.E.
1.Correlation between the scores and the number of years in school.	.29	.13	.24	.13
2.Between the scores and the number of years of farming.	.12	.12		

The standard errors of the differences between the means and the medians are so large that there is no significant difference between the two groups.The standard errors of the correlations indicate that they have very little significance.

of correlation between the scores of the tests, made by the farmers, and the number of years they farmed is positive, but so small that one may conclude,that there is very little in farming to increase the science information of the farmer. It may be possible,on the other hand, that the type of science information called for in this test is not closely related to the type of information used by the farmer. The fact that the coefficient is positive is significant ; for one might expect it to be negative due to forgetfulness.

C. FINDINGS OF THE TEST AS DETERMINED BY THE PER CENT OF EACH GROUP MISSING OR OMITTING EACH OF THE ITEMS IN THE SIX SUBJECT MATTER DIVISIONS.

1.Findings for the Superstition Division.(Table VII.) Superstition is not a subject on the high school curriculum, but the test included such items of superstition which were closely related to science. There were twenty-two items in the test closely related to superstitious beliefs. The items were arranged in descending order according to the percent missed or omitted by the two groups.

Some of the generalizations for this division of the test follow:

a.The farmers missed eleven of the items related to superstition more frequently than the future farmers; while the future farmers missed the same number of items more frequently than the farmers. The mean per cents for each item for the two groups are practically the same. These factors in-

TABLE VII.

FINDINGS OF THE TEST AS DETERMINED BY THE PER CENT MISSED OR OMITTED FOR BOTH GROUPS OF EACH ITEM RELATED TO SUPERSTITION. (ITEMS ARE ARRANGED IN DESCENDING ORDER OF PER CENT MISSED OR OMITTED FOR THE COMBINED GROUPS.)

Item		Per cent missed or omitted by: Farmer	F.F.A.	Combined groups.
1.The best treatment for weak arches is to wear arch supporters.	(F)	88	79	83
2.Ice cream and fish should never be eaten to-gether.	(F)	69	61	65
3.The sap in trees goes up in spring and down in fall.	(F)	50	75	63
4.Strong drink keeps one warm.	(F)	48	64	56
5.There is no such thing as "pigeon's milk".	(F)	52	54	53
6.A person falling from a great height is dead before reaching the ground.	(F)	60	46	53
7.A cat can see better in daytime than at night.	(T)	60	46	53
8.If you apply clay to a sting, it will draw out the sting.	(F)	50	50	50
9.That the ostrich hides its head in the sand is a myth.	(T)	46	52	58
10.Children should have the measles,for the measles are often fatal to older people.	(F)	54	29	42
11.Only by actual biting can a snake poison an individual.	(T)	31	45	38
12.Snakes have a dry,scaley skin.	(T)	31	43	36
13.Aching corns are a sign of rain.	(F)	42	27	35
14.Chimney sparrows breed or bring bedbugs.	(F)	43	22	33
15.A pound of feathers is lighter than a pound of lead.	(F)	21	29	25
16.The dragon fly,commonly called the snake doctor,is of benefit to the common water snake.	(F)	29	18	23

TABLE VII (continued)

17. Fish hung in the moonlight will spoil more quickly.	(F)	23	16	19
18. Most advertised cures for deafness are worthless.	(T)	15	23	19
19. If thistles are cut in August in the sign of Leo, they will not sprout again.	(F)	15	21	18
20. As the last Friday of the month so the next month.	(F)	15	18	16
21. Boils are caused by bad blood in the body.	(T)	13	11	12
22. Frogs should not be killed because they catch and eat many harmful insects.	(T)	10	4	7
Total per cent for all items-		865	833	847
Mean per cent missed of omitted for each item.		39	38	38

dicate a failure of the public schools to annul teachings of superstitious beliefs.

b.The surprising item of high rank is the one on the common belief that fish and ice cream should not be eaten to-gether. The high percentages of the groups missing indicates a prevalent belief of that misconception.

c.The combined mean percentage of thirty-eight is relatively low and may show a gradual improvement in the amount of science information.

d.The greatest marked difference between the two groups was the one relating to the flow of sap in the tree during the seasons of the year. The high percentage on the part of the future farmers may be due to a partial understanding of the flow of the sap in the trees.

2.Findings for the Biology Division.(Table VIII).There were twenty-three items in the test related directly to biology. Some of these items were related to other subjects.

Some of the reasonable generalizations which might be noted are;

a.Both groups missed the item,stating that evolution says that man descended from a monkey, by a very high percentage. A strong religious influence in the county may be a partial explanation of this fact. It is interesting to note that only sixty-two per cent of the farmers missed it; while

TABLE VIII.

FINGINGS OF THE TEST AS DETERMINED BY THE PER CENT MISSED OR OMITTED BY THE COMBINED GROUPS FOR THE ITEMS RELATED TO BIOLOGY. (ITEMS ARE ARRANGED IN DESCENDING ORDER ACCORDING TO THE PER CENT MISSED OR OMITTED BY THE COMBINED GROUPS.)

Item		Per cent missed or omitted by: Farmer	F.F.A.	Combined groups.
1.Leaves of trees turn to sunlight,because they need sunlight for growth.	(F)	81	93	87
2.Evolution says that man descended from the monkey.	(F)	62	70	66
3.The sap of trees goes up in spring and down in fall.	(F)	50	75	63
4.There is no such thing as "pigeon's milk".	(F)	52	54	53
5.A cat can see better in the daytime than in the dark.	(T)	60	46	53
6.That the ostrich hides its head in the sand is a myth.	(T)	46	52	49
7.The common fertilizers contain but a few of the materials needed for plant growth.	(T)	29	66	48
8.Only by actual biting can a snake poison and individual.	(T)	31	45	38
9.Alfalfa and clover are planted only as forage and food for animals.	(F)	50	25	37
10.The trichina is a dangerous worm found in old vinegar.	(F)	29	45	37
11.Snakes have a dry,scaley skin.	(T)	31	43	37
12.The earthworms are economical and valuable animals because they bring fertile subsoil to the surface.	(T)	27	43	35
13.The corn plant produces no flowers.	(F)	38	30	34
14.Chimney sparrows bring or breed bedbugs.	(F)	42	21	32

TABLE VIII(continued)

15.The production of clover seed is made possible by frequent visits of the bumblebee to the flowers.	(T)	17	39	29
16.The color of deep bodies of water is due to the sand or ground in the bottom.	(F)	33	22	27
17.The dragon fly, commonly called the snake doctor,is of benefit to the common water snakes.	(F)	29	18	23
18.Milk is pasteurized to remove the disease germs.	(T)	13	22	18
19.Bacteria,one celled plants,are known to be the cause of many of our diseases.	(T)	13	18	16
20.The white maggots,so frequently seen in manure piles, develop into flies.	(T)	11	7	9
21.Since plants alone can manufacture food, all animals are directly or indirectly dependent on plants.	(T)	4	12	8
22.Frogs should not be killed,because they catch and eat many harmful insects.	(T)	10	4	7
23.Dandelion seeds are scattered by the wind.	(T)	6	7	6
Total per cent for all items-		762	857	812
Mean per cent missed or omitted for each item.		33	37	35

seventy per cent of the future farmers missed it.

b.By averaging the per cents missed for all items,the farmers show a lower score than the future farmers. The average per cent of the farmers missing each item is thirty-three; while that of the future farmers is thirty-seven.

c.The per cent of the future farmers who missed the item relating to the number of elements in fertilizer is far higher than that of the farmers.

d.The farmers missed fifteen of the twenty-three items related to biology less frequently than the future farmers; while the future farmers missed only eight itemsless frequently than the farmers. The farmers may have had a better opportunity of personal contact with the factors related to biology than the future farmers. There is a slight possibility that the farmers would show a lower per cent missed in the other subjects if they had a similar opportunity of personal contact with them in their environment.

3.Findings for the Chemistry Division. (Table IX.) There were twenty-one items in the test closely related to chemistry. These items were arranged in descending order as determined by the per cent of both groups who missed or omitted each item.

A study of the table of the division related to chemistry

TABLE IX

FINDINGS OF THE TEST AS DETERMINED BY THE PER CENT MISSED OR OMITTED BY BOTH GROUPS FOR EACH ITEM RELATED TO CHEMISTRY. (ITEMS ARE ARRANGED IN DESCENDING ORDER OF THE PER CENT MISSED OR OMITTED BY THE COMBINED GROUPS.)

Item		Per cent missed or omitted; Farmer	F.F.A.	Combined groups.
1.The oxygen in the air is the cause for all combustion,and burning,and necessary for all life.	(F)	81	92	86
2.Copper is the best conductor of electricity.	(F)	85	71	78
3.An example of a strong alkali is carbolic acid.	(F)	54	53	54
4.Steel is pure iron.	(F)	48	41	45
5.Water is"hard" because of the salts dissolved in it.	(T)	47	39	43
6.Brass is a metal mined in certain parts of the United States.	(F)	43	39	41
7.The gas,which is used in stoves and distributed through pipes,is mined.	(F)	42	39	41
8.Gold is the most valuable metal.	(F)	35	41	38
9.Glass is made from sand and soda.	(T)	38	30	34
10.The acid found in the storage batteries is strongest when the battery is weak.	(F)	37	29	33
11.Rayon is a type of cloth made from wood pulpp.	(T)	44	16	30
12.The " silver paper" used to wrap candy is a cheap form of silver.	(F)	29	30	30
13.The blacksmith tempers steel by running a current through it.	(F)	23	25	24
14.Carbolic acid is poisonous.	(T)	13	23	18
15.Quicklime is made by heating ordinary sandstone.	(F)	17	16	16

TABLE IX (continued)

16.One would take baking soda for an acid stomach.	(T)	11	20	15
17.Iron is secured from its ore in a blast furnace.	(T)	13	16	14
18.Sulfur is found in coal.	(T)	6	16	11
19.An explosion of gunpowder is a type of very rapid burning.	(T)	11	11	11
20.Grease can be removed from clothing with the use of gasoline.	(T)	13	7	10
21.Soaps are made from alkalies such as lye,and fats.	(T)	4	5	4
Total for all items.-		694	659	676
Mean per cent missed or omitted for each item.-		33	31	32

shows the following generalizations:

a.The future farmers missed only seven of these items more often than the farmers. However, the mean per cent for each item for both groups is lower than one would expect.

b.Both groups missed the item referring to copper as the best conductor of electricity by a high per cent. The likelihood is that both groups learn more from actual observation than from formal education.

c.One of the items missed least by the both groups was the one about soap making. The correct answers may be due to the fact that many of the farmers make their own soap in the county.

d.The only item in which there was a marked difference between the two groups was the one concerning the source of rayon. Some indication of formal education may be noted here.

4.Findings for the Physics Division.(Table X.) There were sixteen in the test directly related to physics. These items were arranged in descending order of the percent of misses or omissions. A few of the generalizations derived from the study of the physics division of the test are:

a.The greatest difference between the responses of the two groups occurred in the physics division.The main reason for this marked difference may be due to the technical nature of the statements. Some indication of the lack of use of this type of science information on the part of farmers is

TABLE X.

FINDINGS OF THE TEST AS DETERMINED BY THE PER CENT MISSED BY BOTH GROUPS FOR EACH ITEM RELATED TO THE SUBJECT PHYSICS. (ITEMS ARE ARRANGED IN DESCENDING ORDER OF PER CENT MISSED OR OMITTED FOR THE COMBINED GROUPS.)

Item		Missed or omitted by Farmer	F.F.A.	Combined groups.
1.The lever used for lifting a stone uses less energy than lifting it directly.	(F)	90	82	86
2.Electricity moves from the negative pole of a battery to the positive.	(T)	63	41	52
3.It would be dangerous to connect a 220 volt electric iron to a 110 volt current.	(F)	52	52	52
4.A body one half as heavy as water will float with three-fourths of its volume under water.	(F)	62	30	46
5.Due to the time needed for radio messages to travel,radio time is a minute or two late.	(F)	48	43	46
6.Fuses are placed in buildings to protect them from lightning.	(F)	67	18	43
7.There are many machines whose efficiency is as high as 99 or 100 per cent.	(F)	46	34	40
8.A solid iron bar is stronger than a hollow one of the same diameter.	(T)	40	39	40
9.D.C. and A.C. are different types of electricity.	(T)	38	36	37
10.Winds blow from places of low pressure to places of high pressure.	(F)	54	18	36
11.Force,power,work mean the same thing.	(F)	40	33	36
12.In a plane mirror,the image is as large as the object.	(T)	25	39	32

TABLE X(completed)

13.The greatest height to which water can be lifted in a siphon is fifty feet.	(F)	40	21	30
14.Liquids tend to rise in small tubes,spaces,or cracks.	(T)	25	29	27
15.A pound of feathers is lighter than a pound of lead.	(F)	21	29	25
16.One sees lightning before one hears the thunder because light travels faster than sound.	(T)	6	7	6
Total for all items-		718	551	628
Mean per cent missed or omitted for each item-		45	34	39

is evident here.

b.Of the sixteen items in the physics division of the the test, the farmers missed eleven of them more frequently than the future farmers.

c.The farmer group missed the items of the physics division more frequently than the items of any of the other divisions.

d.The item showing the greatest variation between the two groups occurred in the physics division. The farmers missed the statement about fuses being placed in buildings to protect them against lightning sixty-seven per cent of the times; while the future farmers missed the same item only eighteen per cent of the times.

5.Findings of the Health Division of the test.(Table XI.) There were ten items in the test directly related to health education. Some of these items are closely related to some of the other divisions. The order of arrangement was the same as in the other division. A few of the findings of the health division of the test show that:

a.There is no marked difference between the number of items missed by the farmers and the future farmers.

b. The high per cent of the future farmers,who think that strong drink makes one warm, was a surprise. The farmers showed a more reasonable response.

TABLE XI.

FINDINGS OF THE TEST AS DETERMINED BY THE PER CENT OF BOTH GROUPS WHO MISSED OR OMITTED EACH ITEM RELATED TO HEALTH. (ITEMS ARE ARRANGED IN DESCENDING ORDER OR THE PER CENT MISS- OR OMITTED BY THE COMBINED GROUP.)

Item		Per cent missed or omitted: Farmer	F.F.A.	Combined groups.
1.Ice cream and fish should never be eaten to-gether.	(F)	69	61	65
2.Doctors do not know the cause of influenza or "flu".	(T)	50	74	62
3.Strong drink keeps one warm.	(F)	48	64	56
4.Diabetes is the result of a poorly functioning liver.	(F)	60	39	50
5.Children should have the measles,for measles are often fatal to older people.	(F)	54	29	41
6.Milk is pasteurized to remove the disease germs.	(T)	13	32	23
7.Most advertised cures for deafness are worthless.	(T)	15	23	19
8.One would take baking soda for an acid stomach.	(T)	11	20	16
9.Bacteria, one celled plants, are known as the cause of many of our diseases.	(T)	13	18	15
10.Boils are caused by bad blood in the body.	(T)	13	11	12
Total for all items-		346	371	359
Mean per cent missed or omitted for each item-		35	37	36

c.Of the ten items in the health division of the test the future farmers missed six of them more frequently than the farmers.

6.Findings for the general science division.(Table XII.) This division includes those item which are related to science, but are not closely related to the other specific science fields included in this test. There were eight items listed in the general science division. A few of the generalizations for the general science division follow;

a.The two groups combined missed the items of the general science division more frequently than the items of any other division included in the test.

b.Both groups missed the statement about the nearness of the earth to the sum at different seasons of the year in a surprisingly large per cent of the cases.

c.In five of the eight items in the general science division, the farmers showed a greater percentage of misses than the future farmers.

7.Findings from a composite summary of all divisions of the test.(Table XIII.) The mean per cents of misses for each item for each of the six science divisions of the test were listed separately for study. Some fair conclusions which may be drawn from this study are;

a.The farmers show the best responses in the chemistry and biology divisions;while,the future farmers show their

TABLE XII.

FINDINGS OF THE TEST AS DETERMINED BY THE PER CENT OF BOTH GROUPS WHO MISSED OR OMITTED EACH ITEM RELATED TO GENERAL SCIENCE. (ITEMS ARE ARRANGED IN DESCENDING ORDER OF THE PER CENT MISSED OR OMITTED BY THE COMBINED GROUPS.)

Item		Per cent missed or omitted: Farmer	F.F.A.	Combined groups.
1.The lever used for lifting a stone uses less energy than lifting it directly.	(F)	90	82	86
2.The sun is nearer the earth in summer than in winter.	(F)	63	71	77
3.If you hear a train whistle at a distance,it is a sign of rain.	(T)	66	64	65
4.Winds blow from places of low pressure to places of high pressure.	(F)	54	18	31
5.The greatest height to which water can be lifted by a siphon is fifty feet.	(F)	40	21	30
6.The sun is the source of all the earth's heat and energy.	(T)	11	22	17
7.Weather reports are guesses made by the United States weather bureau from the appearance of the sky.	(F)	17	11	14
8.Wheat fields are protected by a covering of snow.	(T)	2	11	6
Total for all items-		343	300	326
Mean per cent missed or-omitted for each item.-		43	38	41

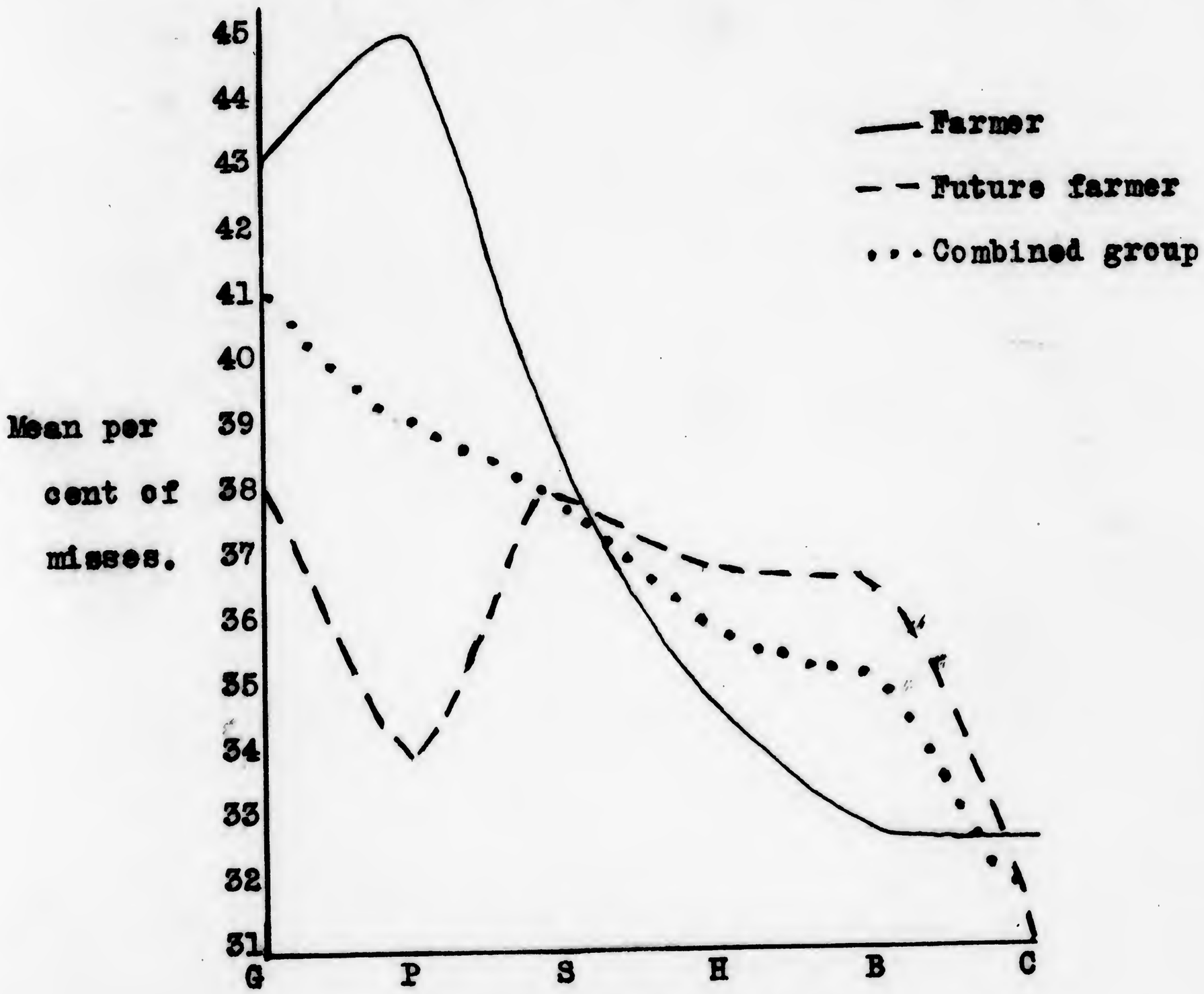
TABLE XIII.

COMPOSITE SUMMARY OF THE MEAN PER CENTS MISSED AND OMITTED BY BOTH GROUPS FOR EACH ITEM IN THE SUBJECT MATTER DIVISIONS.

Subject.	Mean per cent missed or omitted by:		
	Farmer	F.F.A.	Combined groups.
General science	45	38	41
Physics	45	34	39
Superstition	39	38	38
Health	35	37	36
Biology	33	37	35
Chemistry	33	31	32
Composite total for all subject matter divisions.	228	215	221
Mean per cent	38	36	37

CHART I.

EXTEND OF SCIENCE MISCONCEPTIONS HELD BY FARMERS AND FUTURE FARMERS AS DETERMINED BY THE MEAN PER CENT OF EACH GROUP MISSING EACH ITEM OF THE SUBJECT MATTER DIVISIONS OF THE TEST.



G--General Science; P--Physics; S--Superstitions; H--Health; B--Biology; C--Chemistry.

best responses in the same divisions. The future farmers show the poorest response in the general science and the superstitions divisions. The farmers made their poorest response in the general science and physics divisions.

b/ In the health and biology divisions,the farmers made a better average of correct answers than the future farmers. In the other four fields,the future farmers made the better showing.

D. FINDINGS AS DETERMINED BY THE PART OF THE TEST WHICH ASKED THE PARTICIPANTS TO CHECK THE SUBJECTS THEY THOUGHT SHOULD RECEIVE MORE EMPHASIS IN OUR HIGH SCHOOLS.(Table XIV.)

Some of the interesting findings,indicated by listing the subjects checked by each group and than ranking them, are:

1.Both groups are aware of the need of formal and practical instruction in agriculture.

2.Both groups listed safety education,second only to agriculture, as needing more emphasis in our high schools. Such a response is rather remarkable,and indicates a widespread need for that type of instruction.

3.That both groups should check art so infrequently was rather surprising. It may be safe to observe that there may be little need for aesthetic appreciation in agriculture from the farmers'point of view.

TABLE XIV.

SHOWING THE PER CENT OF EACH GROUP WHO CHECKED CERTAIN SUBJECTS AS NEEDING MORE EMPHASIS ON THE HIGH SCHOOL CURRICULUM.

Subject	Farmer	Rank	F.F.A.	Rank.
1.Agriculture	65	1	79	1
2.Safety Education	64	2	72	2
3.Home Economics	52	3	51	8
4.Health	50	4	45	10
5.Physical Education	44	5	52	7
6.Shop	42	6.5	63	4
7.Chemistry	42	6.5	46	9
8.Electricity	38	8.5	54	6
9.Automobile Mechanics	38	8.5	61	5
10.Athletics	27	10	70	3
11.Radio	25	11	34	11
12.Commercial Education	23	12.5	25	14.5
13.Botany	23	12.5	25	14.5
14.Biology	19	14	32	12
15.Art	3	15	29	13.

4.Farmers seem to think that there is little need for commercial education in our schools. None of the schools, included in this test,were offering commercial education.

E. SUMMARY.

1.Items requiring formal education were missed more frequently than items requireing practical observation.

2.The small amount of difference between the two groups in their scores indicates a fair correlation between the science educational needs of the farmer and the science instruction of our schools. However,further evidence is needed to verify this point.

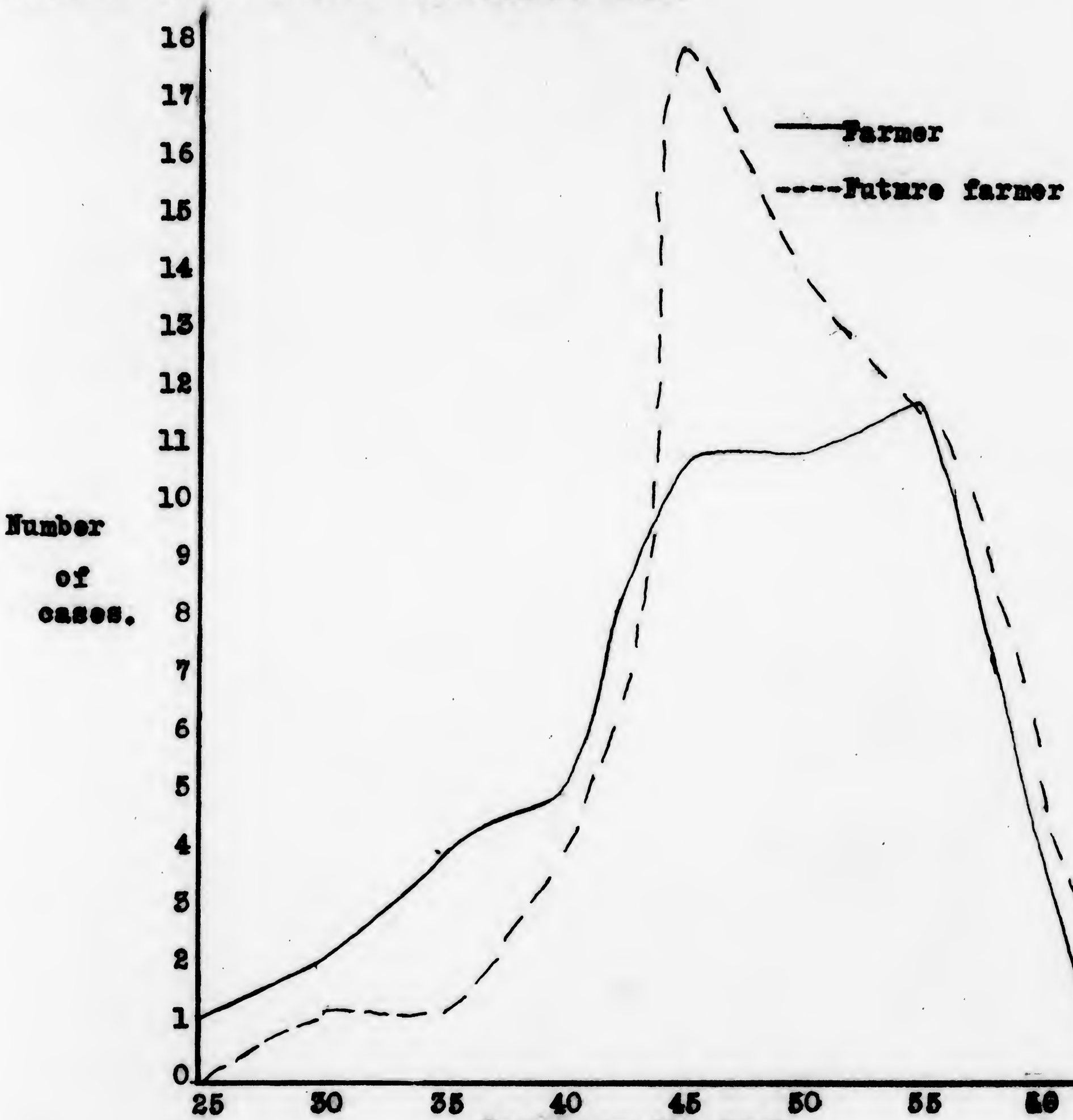
3.Farmers are using more practical science information than that of a strictly technical nature.

4.Both the farmers and the future farmers express a need for instruction in agriculture and safety education in our high schools.

5.There were no startling findings in any part of the findings of the test.

CHART II.

DISTRIBUTION OF THE SCORES MADE BY THE FARMERS AND THE FUTURE FARMERS ON THE SCIENCE INFORMATION TEST.



CHAPTER FOUR.

SUMMARY AND CONCLUSIONS.

A.SERIES OF GENERAL CONCLUSIONS.

1. The largest amount of science misconceptions held by the farmers and the future farmers was of a technical nature. It is quite to be expected that practical material is more easily understood than material of a more technical nature.

2.There is some evidence in the results of the test, that farmers and future farmers learn to correct science misconceptions by direct observation.

3. The test shows very little difference between the science information and misinformation of the farmer and the future farmer.

4.There is a positive correlation between the amount of science information and the number of years spent in school. The coefficient may be smaller than one would expect,but it is large enough to show a definite relationship.

5.There is a slight positive correlation between the amount of science information on the part of the farmer and the number of years of farming.

6.The farmers seem to be slightly more superstitious than the future farmers. However,there is very little indication of much improvement.

7.The farmers excell the future farmers in biological and health information. The future farmers excel the farmers in the fields of physics,chemistry,and general science information.

8.Formal education has done little to remove ceratin types of misconceptions from the beliefs of the individuals here studied.

9.Both the groups,studied,expressed the belief that certain practical fields of instruction should receive more emphasis in our high schools. This in harmony with the growing philosophy that our schools should be more closely related to actual life situations.

10.This study opens a large field for further research. One might determine the amount of science information of many other groups of our population.

B.INTERPRETATION OF THE RESULTS.

1.The items of this test were objective in nature, and as far as possible were objectively administered. The future farmer group took the test under classroom conditions. The farmers took the test individually,but the conditions were such as to produce an objective response. All the tests were corrected by the author. All the results were objectively handled.

2. The results of the test were derived directly from the test responses and are in no way absolute for all conditions. There are many factors which have not been considered.

C. LIMITATIONS OF THE CONCLUSIONS.

1. The test made no attempt to correlate such factors as the IQ,the socio-economic background with the amount of science information.

2.The material was taken directly from other sources. No consideration was given as to whether or not it should appear in those sources.

3.Eighty items could hardly cover the entire field of science information. The study was interested only in certain types of science information.

4.The groups were representative of only a small section of the ountry. The study is largely suggestive and by no means conclusive. The groups were limited in number.

5.The future farmer group was a more homogeneous group than the farmer group.

APPENDICES

APPENDIX A.

A LIST OF THE VOLUNTARY SUGGESTIONS OF THE FARMERS.

1.Don't show preference. Treat all pupils alike.

2.Consolidation of county schools.

3.Adapt material for use in farm and home.

4.Vary subject in accord with pupil inclinations.

5.Athletics overdone.

6.Health and safety education for all.

7.Home economics for girls.

8.Teach fundamentals.

9.Better moral discipline.

10.More teacher supervision.

11.Sociology and problems of government.

12.Vocational education.

13.High school transportation for nine months.

14.Teach pupils to work; farm work and management.

15.No married women.

16.Music.

17.Civilization.

18.Only four college teachers. year

19.Not so much recreation.

APPENDIX B.

A LIST OF THE VOLUNTARY SUGGESTIONS OF THE FUTURE FARMERS.

1.Gymnasium,shop,and study hall.

2.Carpentering,science,debates.

3.How to use leisure time.

4.Gymnasium and shop.

5.Shop

6.Manual training.

7.Agriculture.

8.Agriculture,chemistry,and physical education.

9.Mechanics and commercial education.

10.Aviation.

11.More courses than college preparatory.

12.Household chemistry.

13.More consolidation.

14.More gymnasiums,shops,and libraries.

15.Better ventilation.

16.Air conditioning.

17.Young capable teachers.

18.Modernized equipment.

APPENDIX C.

MEAN SCORES OF THE FARMERS GROUPED ACCORDING TO EDUCATIONAL ATTAINMENTS.

Educational group	number	rank	mean score.
Farmers who attended college or normal school.	8	1	58.25
Farmers who attended high school.	18	2	51.72
Farmers who attended country or grade school.	26	3	44.58

BIBLIOGRAPHY

MATERIALS ON SUPERSTITIONS.

Caldwell,Otis W.,and Lundeen,Gerhard E.,"Students' Attitudes Regarding Unfounded Beliefs", Science Education Vol.15 (May 1931) pp. 246-262.

Caldwell,Otis W., "Do You Believe It", Doubleday,Doran and Company,New York,(1934).

Fogel,Edwin Miller, "Beliefs and Superstitions of the Pennsylvania Germans", American-Germania Press,Philadelphia, (1915)

REPORTS AND BULLETINS.

Report,National Association for Research in Science Teaching, Committee on Secondary School Science, Science Education Vol Vol.22 (October 1938) pp.223-233.

Status of Rural Education,Thirtieth Yearbook,No.1, National Society for the Study of Education,

Vocational Agriculture,Vocational Educational Bulletin,No.191, Agriculture Series,No.50, Office of Education,Washington.

RESEARCH STUDIES.

Caldwell,Otis W.,and Lundeen,Gerhard, "Further Study of Unfounded Beliefs Among Junior High School Pupils", Teachers College Record, Vol.36 (October 1934) pp.35-52.

Clem,Arlie M.,and Dudlestone,Joseph J.,"Factors influencing the Common Science Knowledge of High School Pupils", Science Education, Vol.17,(December 1933) pp.367-272.

Garrett,H.E. and Fisher,T.R., "The Prevalence of Certain Popular Misconseptions," Journal of Applied Psychology, Vol.10,(1926) pp.411-421.

Hamer,O.S.,"Master Farmers of America and Their Education, Doctor's Thesis, (1930) University of Iowa.

Hgatt,A.R.," Achievement of Secondary School Pupils on College Tests," Educational Record, Vol.17,(January 1936) pp.135-138.

Lathrop,F.W.,"Recent Studies in Vocational Agriculture Related to the Establishment of Young Men in Farming," Agricultural Education Magazine,Vol.10,(March 1938) pp.174-175.

Maller,Julius B. and Lundeen,Gerhard,"Sources of Superstitious Beliefs," Journal of Educational Research Vol.26, (January 1933) pp.321-343.

Ralya,LynnL. and Ralya, Lillian L.,"Some Misconseptions Held by Prospective Elementary Teachers," Science Education, Vol.22,(October 1938) pp.244-251.

Rhoton,Paul,"Health Misconceptions of Prospective Teachers", Doctor's Thesis,(1932) Pennsylvania State College.

Salt,Benton,"Health Misconceptions of Seventh,Tenth,and Twelfth Grade Students," Journal of Educational Research, Vol.22 (September 1938) pp.61-80.

Stemple,Forrest D.,"Science Needs of Pupils in Small High Schools,Based on an Activity Analysis," Doctor'sThesis, (1930) Cornell University.

Wrightstone, J.Wayne, "Correlation of Natural Science Beliefs With Social and Intellectual Factors," Science Education Vol. 17, (February 1934) pp.10-12.

SCIENCE AND VOCATIONAL REFERENCES.

Curtis, F.D., "Fifty Best Published Investigations in the Teaching of Science for the Years 1931-1937," Science Education, Vol.22, (November 1938) pp.279-282.

Gamble, J.N., "Place of Natural Science in the Programme of High School Graduates," School Review, Vol.39. (March 1931) pp.177-185.

Groom, W.W., "Errors Made by General Science Pupils," School Science and Mathematics, Vol.30, (June 1930) pp.673-675,

Hadley, C.C., "Field Study of Farmers," Agricultural Education Magazine, Vol.10, (January 1938) pp.131.

Tyler, R.W., "What High School Pupils Forget," Educational Research Bulletin, Vol.9, (Nov. 19, 1930) pp.490-492.

Wilson, W.K. and Ashbaugh E.J., "Achievement in Rural and Consolidated Schools," Educational Research Bulletin, Vol.8(1929) pp.358-363.

SCIENCE TEXTBOOKS.

Atwood, William H. and Heiss, Elwood D., Educational Biology, P.Blakistone's Son and Company, Philadelphia, (1928)

Black, Henry N. and Davis, Harvey N., New Practical Physics, The Macmillan Company, New York, (1935)

Duff, A. Witmer and Weed,Henry T., Elementw of Physics, Longmans,Green,and Company, New York, (1931).

Fletcher,Gustav L. ;Smith, Herbert O. ;and Harrow,Benjamin, Beginning Chemistry, American Book Company, New York, (1929)

Fuller,Robert W.;Brownlee,Raymond; and Baker,D.Lee,First Principles of Physics,Allyn and Bacon,New York,(1933).

Hunter,George W.,Problems in Biology,American Book Company, New York, (1935).

Hunter,George W.,New Essentials of Biology,American Book Company,New York, (1923).

Lake,Charles H. and Unseld,George P., A Brief Course in Physics, D.C.Heath and Company New York,(1931).

McPherson,William; Henderson,William F.;and Fowler,George W., Chemistry for To-day,Ginn and Company,New York,(1930).

Meier,W.H.D. and Meier,Lois,Essentials of Biology,Ginn and Company,New York,(1931).

Newell,Lyman C., A Brief Course in Chemistry, D.C.Heath and Company,New York,(1932).

Pieper,Charles J. and Beauchamp,Wilber J.,Everyday Problems in Science, Scott,Foresman,and Company,New York,(1925).

Smallwood,W.M.;Reveley,Ida L.;and Bailey,Guy A.,Biology for High Schools,Allyn ahd Bacon,New York,(1920).

Smallwood,W.M.; Reveley,Ida L.;and Bailey,Guy A.,New Biology,Allyn and Bacon,New York,(1934).

Steward,Oscar M.;Cushing,Burton L.;Towne,Judson, Physics for Secondary Schools, Ginn and Company,(1932),New York.

Woodruff,Lorande, Foundations of Biology, The Macmillan Company,New York,(1930).

SCIENCE AND SCIENCE TEST AND TEST MATERIALS.

Boyer,P.H., and Gordon,H.C., "General Science Objective Tests" Lyons and Carnahan,New York,(1936).

Deyoe,G.P., "Tests in Agricultural Education" Agricultural Education Magazine,Vol. 11(October 1938) pp.74-75.

Downing,E.R.,and McAltae,V.M.,Biology Unit Tests, Lyons and Carnahan,New York (1936).

Frutchey,F.P.,"Illustrated Test Exercises in High School Chemistry" Educational Research Bulletin, Vol.16, (May 1937) pp.275-277.

Henderson,W.D.,"Physics Unit Tests: Arrangement A" Lyons and Carnahan,New York, (1936).

Hughes,A.R.,"The Hughes Physics Scales", Public School Publishing Company,Bloomington,Ill.

Kirkpatrick,J.E.,"New Development in the Field of Objective Testing in Science" Science Education, Vol.17,(April 1933) pp.131-137.

McGill, M.V. and Bradbury, G.M., "Chemistry Unit and Review Tests," Lyons and Carnahan, New York, (1935).

Pieper, C.J. and Beauchamp, W.K., "Objective Unit Tests for Everyday Problems in Science," Scotts, Foreman, and Company, New York, (1935).

Raths, L.E., "Technique for Test Construction," Educational Research Bulletin, Vol.17 (April 1938) pp.85-114.

Ruch, Giles M. and Popenoe, Herbert F., "Ruch-Popenoe General Science Test," World Book Company, New York (1923).

Ruch, Giles M. and Cossman Leo H., "Ruch-Cossman Biology Test," World Book Company, New York, (1924).

Sparks, W.M., "A Test in Agriculture," The Instructor, Vol.47 (September 1938) pp.29.

Weimer, B.R., "Objective Laboratory Test in Biology," School Science and Mathematics, Vol.36 (December 1936) pp.957-959.

End of Title